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TECHNICAL TRAINING FOR INDUSTRIAL RADIOGRAPHERS. FINAL REPORT.

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TO OFFSET THE PROBLEM OF A SHORTAGE OF QUALIFIED TECHNICIANS TO SERVE AS RADIOGRAPHERS IN INDUSTRY, 19 STUDENTS WERE TRAINED IN TWO CLASSES, THE FIRST CONSISTING OF 19, AND THE SECOND OF EIGHTEEN 30-HOUR WEEKS. ORGANIZED FORMAL OR LECTURE-TYPE INSTRUCTION WAS PRESENTED IN SOME SUBJECT AREAS, BUT THE MAJOR EMPHASIS WAS ON LABORATORY EXPERIENCES INCLUDING PREPARING SAMPLES, RADIOGRAPHING EITHER WITH X-RAY OR RADIOISOTOPES, DEVELOPING FILM, AND INTERPRETING RESULTS AS REQUIRED OF LICENSED RADIOGRAPHER PERSONNEL. CLASSROOM AND LABORATORY EXPERIENCES WERE SUPPLEMENTED BY VISITS TO COMMERCIAL TESTING LABORATORIES, FOUNDRIES, AND STEEL FABRICATORS. TESTS, ORAL, WRITTEN, HANDS-ON OPERATIONAL, OR SPECIAL, WERE GIVEN PERIODICALLY. TOWARD THE END OF THE COURSE, A SERIES OF TESTS AND VALIDATED PERFORMANCE TRIALS WAS ADMINISTERED FOR QUALIFYING THE STUDENTS TO MEET THE REQUIREMENTS OF INDUSTRY. ALL GRADUATES WERE OFFERED JOBS IN THE FIELD OF RADIOGRAPHIC INSPECTION. THE LESSON PLANS AND RELATED INFORMATION DATA WERE DEVELOPED IN ROUGH OR BASIC FORM DURING THE FIRST COURSE AND USED, TESTED, AND IMPROVED IN THE SECOND COURSE. AFTER THIS TRIAL AND MODIFICATION, THE LESSON PLANS AND RELATED MATERIALS WERE COMPILED, EDITED, AND ORGANIZED INTO TWO INSTRUCTOR'S GUIDES. THESE GUIDES ARE AVAILABLE AS VT 003 503 AND VT 003 565. (HC)

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The research reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

Engineering Extension Service

Texas A&M University

College Station, Texas

INTRODUCTION:

Radiography, one of a variety of non-destructive testing techniques, is a basic management and engineering component of production processes that is developing with great rapidity. The increasing complexity of technological developments and the severe conditions of service now requires a higher degree of inspection the reliability of which can be insured in part by using film radiography (X-ray and gamma-ray sources) to provide dependable information for research designers, engineers, production men and others in industry concerned with sound practices, dependable products, human safety and lower costs.

There are no known public educational agencies offering preparatory training in radiography and there is a recognized need for competent radiographers in research manufacturing of all types, transportation, aerospace, petrochemical and many other broad fields of endeavor.

The extensive use of radioisotopes involves a personal and public hazard that demands qualified technical personnel to support the widespread emerging new applications and to handle radioisotopes safely. The pre-employment training of industrial radiographers is not only a desirable career preparation for the individual but it is essential to public safety.

Furthermore, the level of competence of those engaged in this work is below desirable standards due to a lack of effective training. Most of the practicing industrial radiographers acquired their skill and knowledge by the "pick-up" method and they need to be up-graded to insure that they perform their work safely as well as efficiently and economically.

Current demand data for licensed industrial radiographers is not available. The U. S. Atomic Energy Commission and State Departments of Health are concerned about the increasing use of radiography and the shortage of qualified individuals who can safely use radioactive isotopes.

This report covers the implementation of a proposal to conduct a training program for two groups of prospective industrial radiographers as the first phase of the development of a regional institute for training non-destructive testing technicians and to compile operational data for use in establishing similar institutes in various geographic locations.

The report includes significant details of the total operation of the two training courses for the development of industrial radiographers conducted at Texas A&M University, together with evaluations and recommendations. It also includes a report of the development and preparation of a comprehensive instructors guide in two volumes containing all lesson plans and course materials used in the effort.

METHOD:

Upon official acceptance of the proposal made by the Engineering Extension Service of Texas A&M University a facility was chosen at the Texas A&M Research

Annex suitable for renovation to house the proposed effort.

The entire structure was renovated to include a modern, safe and completely practical exposure cell large enough to permit occupancy by the entire class during model set-up procedures. The cell was adequately provided with fail-proof door interlocks and an earthen revetment to shield outsiders from harmful radiation.

In addition the facility was provided with a large darkroom capable of housing the entire class with numerous work stations available to allow multiple operations of film loading, developing, drying and other photographic film processing.

A large well-organized class room was included together with three individual film viewing rooms and two laboratory rooms for the preparation of samples and supplies.

An office for the instructor was also provided as well as restroom and leisure facilities for the entire student body.

A portable trailer mounted, darkroom was also constructed for use in radiographing fixed and remote installations. This unit was provided with a darkroom, supply storage facilities and included room for storing the X-ray camera, power generator and isotope storage cells.

Upon completion of the facilities two classes were held. The first of which required 19, 30 hour weeks for its operation and the second was shortened to 18, 30 hour weeks.

The classes consisted of organized formal or lecture type instruction in some subject areas. However, the major emphasis was placed on laboratory experiences where maximum student participation could be achieved. Competent and imaginative instruction was provided with the instructor availing himself of every opportunity to provide educational tours of commercial testing laboratories, foundries and steel fabricators.

All operations required of full fledged and licensed radiographic personnel were covered in the course including preparation of samples, radiographing either with X-ray or radioisotopes, development of film and the interpretation of results.

Numerous periodic tests were given both oral and written as well as hands-on operational tests. A greater appreciation of the comprehensiveness of the course can be achieved by reviewing the lesson plans contained in the instructor's guide volume 1.

RESULTS:

The training as offered was readily accepted and resulted in developing the individual skills of each member of the student body to a level of sufficient excellence to make him an employable individual capable of meeting the exact requirements of the industry in the field of radiographic work. Both in the science of radiography and the interpretation thereof.

In addition the instructor's guide volumes 1&2 are a direct result of this effort. The lesson plans and related information data were developed in rough or basic form during the first class and tried, tested and improved in the second class. After considerable trial and some modifications the lessons were compiled, edited and organized for reproduction.

DISCUSSION:

In the area of student acceptance by industry upon completion of his training the following examples are offered: Of a total of 19 students graduated from the two courses conducted at Texas A&M University all graduates were offered jobs in the field of radiographic inspection and all but two are presently engaged in this type of work. One student enlisted in the Air Force and is attending classes in nondestructive testing at Chanute Field, Illinois and the activity of the other is unknown.

While there were a considerably greater number of job offerings than there were graduates, students did not accept the highest paying position or the best opportunity for advancements because in some instances they permitted factors of geographic location or pressure of operations to be the determining influence.

One Latin American student was able to obtain immediate employment in his home town (Corpus Christi) and is presently earning \$500 per month having previously worked as a Medical Technician at \$300 per month. Another student is licensed in the State of Arkansas and is the Company's Radiation Safety Officer. Still another is working for a missile parts plant in Houston.

An interesting side note regarding the students attending these two courses has to do with their point of origin, one applied while working in Side Point, Alaska, another came from England and is presently working as a full fledged radiographer in Peru, South America.

In the matter of student evaluation, tests were administered on a daily basis and at the conclusion of each lesson. Other special tests were given at appropriate times throughout the course. An example of one of the special tests consisted of a written test made up of twenty questions and problems, interpretation of 50 radiographs requiring the student to list three defects or artifacts in each of the submitted film and finally the actual taking of a radiograph.

Toward the conclusion of the course a series of tests were given to qualify the students in accordance with the requirements of the American Petroleum Institute Code 1104 pertaining to oil and gas pipeline radiography.

Other tests included the Canadian Government Test for industrial radiographers, the Magnaflux Corporation Senior Radiographers Test, the Pickers X-ray Test and a variety of other validated performance trials.

CONCLUSIONS, IMPLICATIONS & RECOMMENDATIONS:

The evaluation of the course on the basis of its future operation must take into account several conditions and situations.

The course as it was originally presented required 19, 30 hour weeks for its completion.

This was cut to 18, 30 hour weeks in the next offering and in the event that it is offered again it will be on a 16, 30 hour week basis. This, however, is the absolute maximum amount of cut possible if the course material presently being used is to be adequately covered.

The reason for shortening the length of the course is to overcome the objection that industry offers when asked to sponsor candidates for the school. They point out that it is just impossible to have their personnel away from their operation for 19, 18 or in some instances even 16 weeks.

When industry was asked to suggest how they would like to see the course offered they suggested a series of evening classes on an area basis. In the Houston area they agreed to 24 weeks at 20 hours per week, management paying all tuition costs.

With this formulae in mind the area was polled to determine the number of enrollees who would actually attend such an offering and 18 responded to the initial proposal.

In addition to the foregoing observations it was at one time considered feasible to expand the course in both time and text to include pulse echo inspections and magnetic particle testing thereby enlarging the scope of the program to embrace more of the nondestructive testing aspects than were included in the initial offering.

Throughout the period of survey amongst the various companies who could use the services being offered there was an underlying unwillingness to become involved. It was readily apparent that industry as a whole is quite content to have their radiographic services provided by testing laboratories rather than get involved in setting up their own facility and employing their own specialist for the service. This fact may well be altered if the field of study would be broadened to include other aspects of non-destructive testing.

Another means considered for the perpetuation of the effort is the junior college. A vocational school in Opelousas, Louisiana and the Orlando Junior College in Orlando, Florida have both expressed considerable interest in the program.

In all of these proposals and counter proposals thoughts were given to how adaptable the Instructors Guide would be if any significant changes were undertaken. The consensus is that with minor modifications the guide would be readily adaptable to most changes suggested and if some drastic changes were contemplated then with the inclusion of some additional material and the modification of some few standard items it would also serve as an excellent guide for the proposed expanded efforts.

SUMMARY:

To offset the problem of dealing with a shortage of qualified technicians

to serve as radiographers in industry, two classes were conducted at Texas A&M University under the direction of the Engineering Extension Service.

Both classes were conducted with above average results and a comprehensive instructor's guide was prepared coincidentally with the effort.

It can be demonstrated that an urgent need continues to exist for this type of training and with only minor modifications of time and subject matter courses can be implemented.

REFERENCES:

All references are contained in volumes 1&2 of the instructor's guide, a part of this report.